ART. XXXVII.—*A New Mosasaur from the Ft. Pierre;* by F. B. LOOMIS.

JUST west of the Black Hills in Wyoming there stretches from southeast to northwest a great belt of black shales of the Ft. Pierre age. The scarcity in them of both invertebrate and vertebrate fossils has caused these beds to be neglected, not to say shunned; for the abundance of alkali in the shales makes camping in the region a dubious pleasure, However on the high ground west of Edgemont, near the heads of the small streams, some vertebrates have been found, the first by the American Museum of Natural History, which however were in such hard concretions as to make their preparation and study impractical, and again by the Amherst College expedition of 1903, these latter being in the shales and in a fair state of preservation. This collection was made at the head of Mule Creek, 20 miles due west of Edgemont, and contains a fair fauna of both invertebrates and vertebrates, the most interesting of which is a set of mosasaur bones belonging to a new species and represented by practically all parts of the skeleton.

The invertebrates occurred in concretions at the same locality and horizon and are useful in determining the age of the horizon. I give the list of shells found which are typically Ft. Pierre species:

Inoceramus sagensis var. nebrascensis Owen
Inoceramus crispii var. barbabini Morton
Yoldia ventricosa M & H
Nuculana ? equilateralis M & H
Pteria linguiformis E & S
Pteria nebrascana E & S
Chlamys nebrascensis M & H
Syncyclonema rigida M & H
Protocardia rara E & S
Callista deweyi M & H
Callista peplucida M & H
Anisomyon subovulatus M & H
Entalis ? paupercula M & H
Vanikoro ambigua M & H
Aporrhais biangulata M & H
Fasciolaria ? flexicostata M & H
Heteroceras ? cochleatum M & H

Beside the invertebrates there occurred a series of vertebrates which in their generic features resemble a Niobrara fauna, but they are specifically different though the preservation is not sufficiently good to use them to make new species. In their preservation there was some crushing, and the cracks filled with gypsum, later expanding so that delicate bones are usually distorted and very difficult of preparation.

Elasmobranchii	Corax	represented by	2 teeth and three strings of vertebræ.
Teleostomi	Portheus	" "	one pair of lower jaws.
	Ichthyodectes	" "	18 strings of vertebræ, by portions of the tail, and by the dentale and maxilla.
	Saurocephalus	" "	2 crushed skulls.
	Empo	" "	skull bones and vertebræ.
	Pachyrhizodus	" "	vertebræ.
Reptilia	Platecarpus	" "	many parts of skeletons.
	Elasmosaurus	" "	1 paddle and part of a second.

The mosasaurs were far the most abundant fossil and the best preserved. We found one skeleton with a complete skull followed by 23 vertebræ and their ribs all in place, a second consisting of a disassociated skull, 7 anterior vertebræ and a scattered front paddle, a third consisting of parts of the skull and 56 vertebræ from the mid-body to the middle of the tail, another consisting of the front paddle practically all the phalanges being in place, and a dozen less important specimens, one a considerable part of the posterior paddle. These are the basis of the new species to be described. They were all found within 100 yards of each other not varying in horizon more than 10 or 15 feet.

Platecarpus brachycephalus sp. nov.

I take as the type the disassociated skull, No. 389 in the Amherst Collection, and as a cotype the complete skull No. 398. To what these give, I add data and drawing from some of the other material from the same place and level.

The first question raised is as to the genus of the form. The following table gives the most salient features by which the mosasaur genera are subdivided.

In the brevity and width of the skull, the small number of teeth in the maxilla, the Amherst specimens resemble Brachysaurus, but in the shape of the humerus, in the fact that the suprastapedial process of the quadrate is not coosified with the base of the quadrate behind, and in the fact that the chevrons of the caudal vertabræ are free and articulated to the centra, it resembles Platecarpus. In the major and in a number of minor features the form is intermediate in character between the Ft. Pierre genus Brachysaurus and the Niobrara genus Platecarpus, but I consider it nearer to Platecarpus as its differences from Platecarpus are mostly in degree, while those from Brachysaurus are positive ones and mark a wider diver-

Genera	Horizon	Praemaxillo-nasals	Maxilla	Quadrate	Caudal vertebræ
Clidastes	Niobrara to Ft. Pierre	Rostrum sharp, of mod. length: median ridge separate teeth	15–16 teeth	small: suprastapedial process long but not fused.	7 pygals: chevrons fused: tail broadened.
Tylosaurus	Niobrara	Rostrum very large and long: smooth below	13 teeth	medium: suprastapedial process small, not fused.	6 pygals: chevrons articulated.
Mosasaurus	Niobrara	Rostrum medium size and short: median groove.	14 teeth	medium: suprastapedial process short, not fused.	
Brachysaurus	Ft. Pierre		11 teeth	moderately large: suprastapedial process long and fused.	chevrons fused:
Platecarpus	Niobrara to Ft. Pierre	Rostrum small, obtuse, and short: smooth below.	12 teeth	large: suprastapedial process large, not fused.	5 pygals: chevrons articulated.
Amherst specimen	Ft. Pierre	Rostrum small, obtuse, and short: median ridge behind teeth.	11 teeth	large: suprastapedial process very large, not fused.	5 pgyals: chevrons articulated.

gence. I have therefore placed this in the genus Platecarpus* though I realize that it represents an intermediate relationship.

Platecarpus has a couple of rather doubtful Ft. Pierre species, ? *P. latispinis* Cope, based on one cervical and five dorsals, peculiar in the considerable length of the diapophyses, and of a size about 25 per cent larger than *P. bachycephalus*: and *P. tectulus* Cope, based on a number of cervical and dorsal vertebræ of unusually small size. The Amherst material can not be associated with either of these.

The skull as a whole is remarkable for its extreme brevity and width. As found it is crushed from above downward, to which is due the abnormal position of the jugal bones (see fig. 1). The nares are well forward, short and relatively wide. The orbits are short and wide. The exoccipital region is prolonged considerable back of the condyle, much further than

*I use the term Platecarpus for this genus as the one in common use. Hay, in his Bibliography of Fossil Vertebrates of North America 1902, uses Marsh's name, Lestosaurus. The priority is dependent on the final determination of dubious types, which has not yet been done. See Williston, Univ. Geological Survey of Kansas, vol. iv, p. 178.

usual. The total length of the skull from the snout to the occipital condyle is 510^{mm}.

The premaxillæ are fused to each other and to the nasals, and are characteristically short and blunt, making a very short rostrum in front of the four teeth, which they carry. On the ventral surface there originates a median carina just behind

Fig. 1.

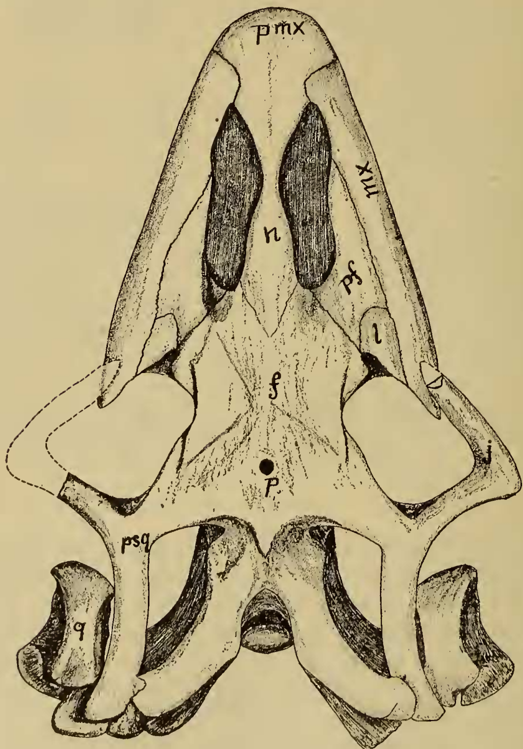

Fig. 1. Top view of the skull of the cotype. 1/6 nat. size. *f*, frontal; *j*, jugal; *l*, lacrymal; *mx*, maxilla; *n*, nasal; *p*, parietal; *pf*, prefrontal; *pmx*, praemaxilla; *psq*, presquamosal; *q*, quadrate.

the teeth, which does not project between them, but is continued backward onto the vomers. Between the nares the fused nasals make a moderately wide septum, which however in the middle of the span is narrowed for a short distance to about 10^{mm}.

The vomers are wide and fill in the anterior part of the space between the maxillæ. The sutures about the vomer are not clear, but the species is peculiar in that the palatal vacuity (which is usually in two parts, a smaller anterior and a larger posterior) is so reduced that only the posterior portion remains open.

The maxillæ are heavy bones and each carry but 11 teeth, (a very small number for any mosasaur) which are the typical acrodont, striated, conical teeth, compressed toward the points from the inside toward the outside. These teeth like those of the lower jaw are rather slender, and from 25 to 30^{mm} long. All eleven need not be on the jaw at once, for the replacement is of the typical reptilian type in which there is a tendency for each alternate tooth to be in some stage of replacement, in which case even the bony base on which they are situated may be for the time eliminated.

The prefrontal is short and wide and extends about half way along the external margin of the naral opening, as is typical in Platecarpus. The lachrymal is of small size and bounds the anterior external side of the orbit.

The frontals are fused into a broad roofing bone, extending from the nares back almost to the parietal opening. There is little distinctive about this bone, except that on either side is a groove beginning shortly behind the naral opening, extending backward obliquely toward the median line, then turning sharply outward and dying out near the orbit about opposite the parietal foramen.

The parietal is not so bounded that the outline can be made out, but it has a fair-sized parietal foramen. The preservation of the back of the skull does not permit describing the sutures of such bones as the postfrontal, the presquamosal, postorbital, or exoccipital.

The jugal makes a short arch, which in the specimen found extends laterally; but this is doubtless due to crushing, the normal position of the bones being under the orbit, in which case there is nothing unusual about this bone.

The quadrate is very characteristic, first in its large size as compared with the rest of the skull. Its lower articular surface for the mandible is rather small, and expanded on the outer side. The body of the bone projects forward and swings in an almost complete circle around the auditory meatus, the supra-stapedial process being very large, its distal end almost reaching the base of the quadrate; but there remains a narrow and well marked opening between the end of the process and the base of the bone, which distinguishes the form from Brachysaurus where the process is coosified with the base of the quadrate. On the external face of our quadrate the margin of the upper articulation projects laterally, making a rim which extends clear around to the base, in front being developed into a thin plate. The immediate border of the meatus is also raised in a low rounded ridge, so that between this and the external rim there is a shallow channel. On the inner surface the margin of the meatus is beveled and the external edge rounded. The large oval stapedial pit is situated very high up (see fig. 2) as in Brachysaurus and Platecarpus, lying at the upper end of the meatus notch.

Height of the quadrate	103mm
Greatest width of quadrate	88mm

FIG. 2.

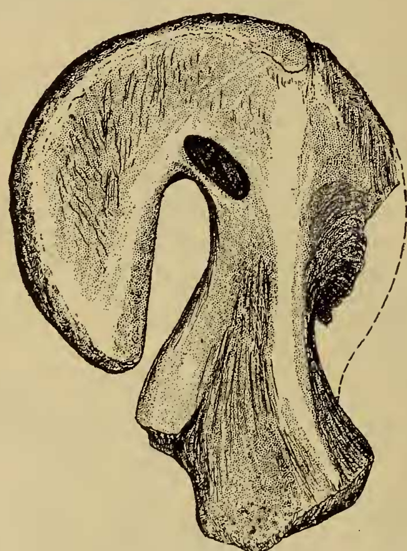

FIG. 2. The quadrate from the inner side showing the stapedial pit. 1/2 nat. size.

The lower jaw is unusually long and fairly slender, and carries in my specimen 7 teeth with places for four more, making a total of 11 teeth for the dentale. This bone projects a short distance in front of the first tooth and extends back so as to make over half of the mandible. Externally it is ornamented with longitudinal striæ. The splenial (presplenial) is exposed externally only below the posterior end of the dentale. The articulare is large and extends from the rear of the dentale back beyond the articular fossa. In this species is found but very little of the articular fossa, that being carried mostly by the supra angulare. This latter bone is unusually large, covering almost all the space back of the dentale and above the articulare, while the coronoid is only a small bone making a low process. In all these features the mandible resembles that of Platecarpus.

Length of the mandible over all	603^{mm}
Greatest depth from coronoid to splenial	136^{mm}
Depth under the last tooth	66^{mm}

For determining the vertebræ specimen No. 388 aids greatly with its 23 vetebræ in place. On this specimen the first long

Fig. 3.

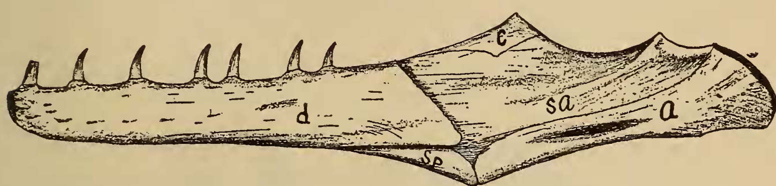

Fig. 3. The mandible from the outer side. 1/6 nat. size. *a*, articulare; *c*, coronoid; *d*, dentale; *sa*, supra angulare; *sp*, splenial.

rib (i. e. probably reaching to the sternum) is on the eighth vertebra. Then follow 10 long ribs, after which the ribs are much shorter. The specimen with 56 vertebræ begins in the middle of the long ribs. There are twelve with short ribs and clearly five which are noncostiferous (at this point the series is disarranged). Following this are 24 anterior caudals with chevrons, then a break of several vertebræ, followed by 14 caudals from well down in the tail. Williston gives the vertebral formula for Platecarpus as 7 cervicals, 22 dorsals, 5 pygals and 80? caudals = 115? for the full series. With the above, the Amherst specimens agree; so that if restored the form, *Platecarpus brachycephalus* would appear just about as does *P. coryphæus** and would be about 15 feet long.

In the cervical series, the atlas consists of three small nodular pieces, of which two are preserved. The intercentrum is a tiny bone with three principal faces, of which the two upper articular ones are slightly concave, while the ventral one is convex with a slight median prominence for muscular attachment. Only one lateral piece is present which is distorted by the infiltered gypsum, but seems to be normal to the genus. The rest of the cervicals have suffered in preservation so that the ends of the spines and processes are crumbled and partly gone. On the axis the odontoid is a separate element, and is a three-sided nodule with a rounded convex anterior surface and

* Williston, Univ. Geol. Survey of Kansas, vol. iv, plate LXXII.

with concave faces on the rear and anterior sides. The axis has a stout nodular hypophysis below and heavy transverse processes. The posterior articular end of the centrum is concave and almost circular in outline. The remaining cervicals are similar in shape, except that the centrum is convex in front and concave behind and the hypophyses are progressively smaller. Each carried a small rib on its transverse process.

The dorsal vertebræ have no hypophyses. The transverse processes are short and heavy, and from the anterior of each process a heavy ridge extends forward continuing into the prezygapophysis. The spines are of moderate height and each

Fig. 4.

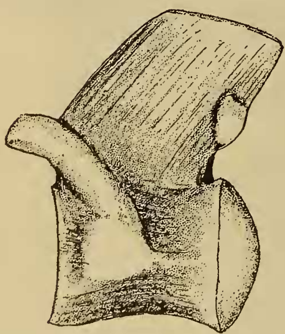

Fig. 5.

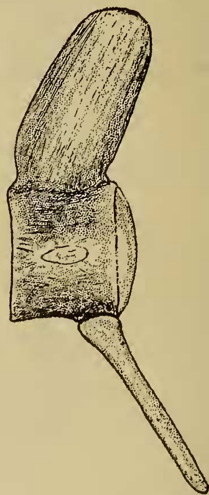

Fig. 4. A dorsal vertebra (6) 1/4 nat. size.
Fig. 5. A caudal vertebra (8) 1/4 nat. size.

about as broad (antero-posteriorly) as the length of the centrum. The postzygapophyses are small and situated above the neural canal on the spines. Each pair is close together, making the interlocking of the vertebræ very close. The neural canal is remarkably small.

The pygal vertebræ (noncostiferous) number five, have no hypapophyses, very large transverse processes, weak zygapophyses and strong spinous processes.

On the caudals the transverse processes at the anterior end grow progressively smaller toward the rear and soon disappear. On the ventral side are chevrons which are free and articulated with the lower surfaces of the centra. In the anterior regions the caudals are robust, but toward the rear become more and more flattened from side to side.

Length of the cervical series (7)	260^{mm}
Length of the dorsal series (22)	1265
Length of the pygal series (5)	250
Length of the caudal series (25 = 1050^{mm}) estimated	2200
Length of the skull	510
	4485^{mm} = about 15 feet.

The ribs are single headed and simple. Their varying length give an idea of the size of the body as follows:

Cervical rib		3	54^{mm}	Dorsal rib		6	420^{mm}
"	"	4		"	"	7	370 +
"	"	5	116	"	"	8	408
"	"	6	132	"	"	9	370
"	"	1	475	"	"	10	350
Dorsal rib		1	320	"	"	11	202
"	"	2	330	"	"	12	175
"	"	3	350	"	"	13	160
"	"	4	410	"	"	14	155
"	"	5	390 +	"	"	15	140

The ossified portion of the scapula has the distal articular end greatly thickened, its rounded roughened surface showing two faces, both convex, the one for the coracoid, the other for the humerus. The neck is strongly constricted; the anterior margin is the shorter, and deeply concave; the posterior border is longer and less concave; the proximal border is rogose and highly convex. The bone as a whole is flat and moderately thin.

The coracoid is larger than the scapula but like it a fan-shaped bone. The articular end is not as swollen as that of the scapula, and it presents two surfaces, the one for the scapula, the other for the humerus. The anterior margin is short and slightly concave; the posterior margin longer and much more concave; the inferior border is convex, and about a fourth of the way from the front has a deep notch as seen in the figure (fig. 7). I do not find beside this a coracoid foramen as is typical for Platecarpus.

The humerus is remarkable for its distal width, being actually greater than the height of the bone (exaggeration of Platecarpus). The proximal end is only slightly convex, the articular surface being greatly thickened opposite the pectoral process. The distal end makes nearly a half circle, the articular surfaces for the radius and the ulna being thickened, between which two surfaces the humerus is pinched into relative thinness. The radial border of the humerus is the shorter and is so concave as to be almost a notch; the ulnar border is slightly longer and not quite so concave. A strong

Fig. 6.

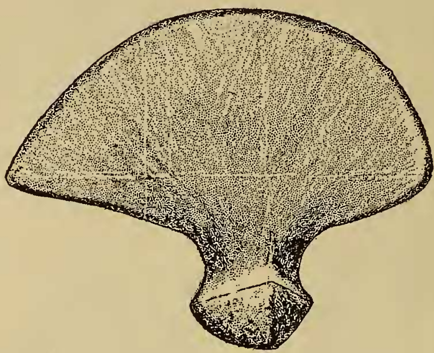

Fig. 6. The right scapular from the outer side. 1/4 nat. size.

Fig. 7.

Fig. 7. The left coracoid from the outer side. 1/4 nat. size.

pectoral process rises a little to the radial side of the humerus and extends three-fourths of the length of the bone; the cartilaginous surface extending about to the middle of the humerus. This is the most strongly developed pectoral process I have seen recorded, being an exaggeration of the large one typical of Platecarpus.

The radius is the larger of the forearm bones. Its proximal end is greatly thickened opposite the middle of the inner side, so that in an end view the articular surface is broadly triangular. The distal end is rounded and but slightly thickened. The anterior border is the longer, both it and the posterior border being moderately concave.

The ulna is the small forearm bone, its upper end being considerably but uniformly thickened. Distally the articular surface is divided into two parts which meet each other in an obtuse angle.

One of the specimens which was found was an approximately

Fig. 8.

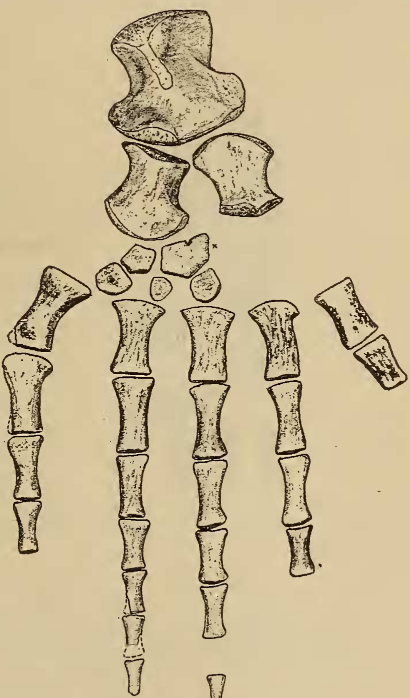

Fig. 8. The anterior paddle seen from the inner surface. 1/6 nat. size.

complete paddle with 6 carpal bones, the metacarpals and phalanges all in place. In fig. 8 these carpals are drawn as they were found, except that the sixth, which lay above the one marked × and was like it including the notch, has been omitted as being either an extra, or at least out of place. All these carpals are probably too far toward the radial side. It is unusual for Platecarpus to have more than four carpals, but it is apparently a feature of this species. The metacarpals are not greatly differentiated though the first is slightly larger than the others. The phalanges are those typical of the genus. We have two paddles to judge from, and they would seem to indicate that the formula was 4 6 6 6 4. This allows for one lacking on the first digit in my drawing, and for three lacking on the fourth and fifth digits.

The hind limb material is not as abundant or perfect as the front limb. I have no ilium or ischium. A femur, which must belong to this form as no other mosasaurs were found here, is a large flattened bone, expanded both proximally and distally. The articular ends, however, are only moderately thickened. The tibia is considerably the larger bone of the

Fig. 9.

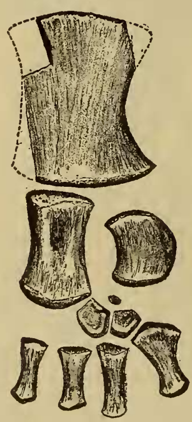

Fig. 9. The hind limb showing the femur, tibia, fibula, tarsals, and four metatarsals. 1/6 nat. size.

two in the fore leg. It has the ends much thickened and expanded. The fibula differs from what would be expected, being very short, the ends thick and expanded, the inner border concave, and the outer convex and much thinned.

In the tarsus three bones were ossified, two larger and one tiny. This again is more ossification than is characteristic of Platecarpus. Four metatarsals were found with this specimen, all of generally uniform size, except that the fifth is expanded proximally as is typical.

Throughout the preceding description the figures are carefully drawn to scale, so that relatively few measurements have been given. I think it entirely safe to take others from the figures.

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